wind, but M. Plantamour thinks it is likely to be fine weather, and on this recommendation I took a place in the diligence for Chamounix. . . .

"*Chamounix, Sept.* 18, 1851.—Last evening the stars were shining through the opening clouds, giving promise of improving weather, but a glance out of the window this morning dispels all such anticipations. . . .

"*Chamounix, Sept.* 19, 1851.—I woke this morning at five, and my first impulse was to go to the window to see the signs of the weather. Last night I had hopes of an improvement. But I was surprised to find a clear sky; some clouds were resting round the *aiguille*, but the summit of Mont Blanc was clear. Started for Montanvert at 7.15 with a guide. . . .

"*Mer de Glace.*— . . . Attempted two or three times to hide the sun's disc by projecting rocks to try to see the red prominences, but could not get a station far enough off. . . .

"*Chamounix, Sept.* 20, 1851.—Snowing fast in morning. Weather desperately bad. But before going to bed it was quite clear. . . .

"*Chamounix, Sept.* 21, 1851.— . . . The fine prospects of last night were effectually put aside by another snow-storm. . . .

Chamounix, Sept. 22, 1851.—The morning bad as usual. . . .

Chamounix, Sept. 23, 1851.—This morning still cloudy, yet the prospect for an improvement was encouraging. Soon after breakfast the sun appeared struggling in the clouds, and I hurried off with a spy-glass not to lose the slightest chance of seeing the phenomena I wished to. . . . I spent two or three hours in the wet fields to no purpose. In the afternoon there was an effort at clearing again.

"*Chamounix to Martigny, Sept.* 24, 1851.—The clouds this morning still hung on the mountains, but overhead there seemed some signs of clear sky. To make sure of losing no chance I took an early breakfast and left for the fields with the ordinary spy-glass belonging to the hotel under my arm. Sometimes it would be almost clear, and then again it began to rain, and I was undecided whether to give up and start for Martigny or to stay another day. At last I saw the sun's disc and took up my station on the edge of the shadow of the *Aiguille de Blettière*. It was still cloudy, but I was satisfied from the nature of the experiment—

"1st. That a very clear air is necessary.

"2nd. Plenty of time to choose projections, affording views of as large a portion of the circumference of the disc as possible while the rest is hidden.

"And lastly, a good achromatic telescope easily moved.

"I did not expect to find it so easy an experiment, nor to find a mass so well fitted for the purpose as the *Aiguille de Blettière*, which has a smooth edge, inclined, so as to allow the sun to disappear slowly behind it,

"The naked eye easily bears a small portion of the sunlight. From 7 to 9½ I followed the shadow over the valley. It was nearly clear for a few moments before it reached the woods on the side of the mountain, but there were still some light clouds over the sun, and nothing could be seen certainly of the corona; the clouds and mist would account for what I did see, and on the other hand the colour of the telescope supplied too much red just at the edge for one to be able to see any of the red flames, if they existed there.

"On the whole, I am more than ever sure that the experiment can be made, and I think will be by some one more fortunate than I."

SOLAR OBSERVATION IN INDIA

NOW that the subject of solar observation in India is likely to occupy the attention of the scientific public, he following details of the Solar Observatory now in progress of construction at Calcutta may be of interest to readers of NATURE.

The suggestion emanated in the first place from the well-known Italian astronomer and spectroscopist, Prof. Tacchini, who was sent to India by the Italian Government as director of the Transit of Venus Expedition. The idea thus put forth was at once taken up by Père Lafont, the principal of St. Xavier's College. A subscription was opened to enable the work to be carried on, and in a short time the collections had amounted to 10,000 rupees, to which the Indian Government added 5,000 rupees. So warmly does the idea seem to have been taken up, that a theatrical benefit was given, at the suggestion of Col. Wyndham, in aid of the Observatory fund.

The observations proposed to be carried out are to supplement those made in Italy, where from November to March (inclusive) the sky is often unfavourable for observation. A complete annual record of changes in the sun's chromosphere, &c., will thus be kept up. With regard to instruments, an equatorial of 7-inch aperture is now being constructed by Merz, but more funds are needed to complete the instrumental "plant" of the Observatory. In course of time it is to be hoped that a transit instrument and a complete set of meteorological apparatus will be added.

The Italian Transit of Venus Expedition has thus been the means of sowing seeds which, finding themselves in a soil most favourable for development, are calculated at no very distant period to bear fruit of the greatest value to science. When in Calcutta with the Royal Society's Eclipse Expedition, last April, I visited the Observatory in company with Prof. Tacchini, and the work of construction was then in a very advanced state. Prof. Tacchini has recently written to say that the building is now almost completed.

The energy which has been displayed in connection with the Calcutta Observatory * redounds greatly to the credit of our Indian colleagues. It is only by systematic observations of this kind, carried on by public enterprise, that we can ever hope to detect cyclical changes in the sun's composition and constitution—changes which, taking enormous periods for their completion, may demand continuous records to be carried on even through many generations.

R. MELDOLA

THE LAWS OF STORMS †

M. FAYE, in the article referred to below, and of which we propose to give an abstract at considerable length, begins by referring to the stupendous force of tropical tempests as contrasted with those of Europe, and to the practical importance of knowing the laws which regulate them. Many persons, he believes, on reading the title of his paper, will be surprised to learn that hurricanes have laws, or will ask what an author means by proposing to expound and vindicate the Law of Storms.

Laws of Storms.—Not only are storms subject to laws of great interest to science, but from these laws practical rules may be deduced which will enable us to avoid these dangers, or escape from them, should we happen to be caught in a storm. These rules are taught in all naval schools, and are the foundation of the sailor's safety. The validity of the laws on which they are based has, however, been disputed by some writers on Meteorology, and therefore the Bureau des Longitudes has authorised the publication of M. Faye's paper, in which he attempts clearly to expound and to defend the disputed laws.

Referring to the valuable labours of Piddington in India and Redfield in the United States, and of Reid, M. Faye says that the only premises they had to start

* The Observatory is situated in St. Xavier's College, Park Street, Calcutta.

† Abstract of a paper, "Défense de la Loi des Tempêtes, par M. Faye, Membre de l'Institut," in the *Annuaire* of the Bureau des Longitudes for 1875.

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from were the idea that there ought to be something regular in the progress of hurricanes, and the observed fact that in every disastrous storm the wind appeared to move in a circle. They said to themselves: "We do not seek to know how storms are formed, but how they progress." Instead of speculating, as did former meteorologists, on storms of aspiration, on the rôle of electricity, on the conflict of opposing currents, &c., they collected for each tempest extracts from the log-books of all the ships which had been involved in it. After having abstracted and arranged this immense quantity of material, they marked upon a chart, at certain dates, the positions of these ships and the direction of the winds observed. Then, by placing on this chart, after several trials, a series of tissue-papers on which had been drawn concentric circles, they made sure that the wind-arrows at the same instant closely coincided with these circles, so that at that very instant, over all the region subjected to the storm, the mass of air resting on the ground or on the sea must have been acted on by a vast gyrating movement around a centre. Some idea of the nature of these researches will be obtained from Fig. 1, which shows a very small part of the chart of the hurricane which ravaged the island of Cuba in 1844. Redfield collected sufficient information to determine the figure of the hurricane at twenty-five different times, between Oct. 4 and 7; the figure shows two of these. The same phenomenon was reproduced at all the other times; everywhere the hurricane assumed this strikingly circular form.

All tornadoes, typhoons, hurricanes, present the same character wherever they occur, and they preserve it throughout the entire duration, and over all their area, which often extends to more than 600 leagues. The conclusion is evident; there is evidence here of a vast rotatory movement, definitively confined to one portion of our atmosphere, which is at the same time subjected to a movement of translation.

It is remarkable that when all the separate results obtained over the whole of the northern hemisphere are compared, it is seen that the gyration takes place always and everywhere from right to left, in a direction opposite to that of the hands of a watch (see Fig. 1). Still more remarkable is it that over all the southern hemisphere the same law, the same gyration is found, but in a direction opposite to that of the preceding, from left to right, *i.e.*, the same direction as that of the hands of a watch. There is here evidently one law, and that a law without exception; these terrible gyratory movements turn constantly

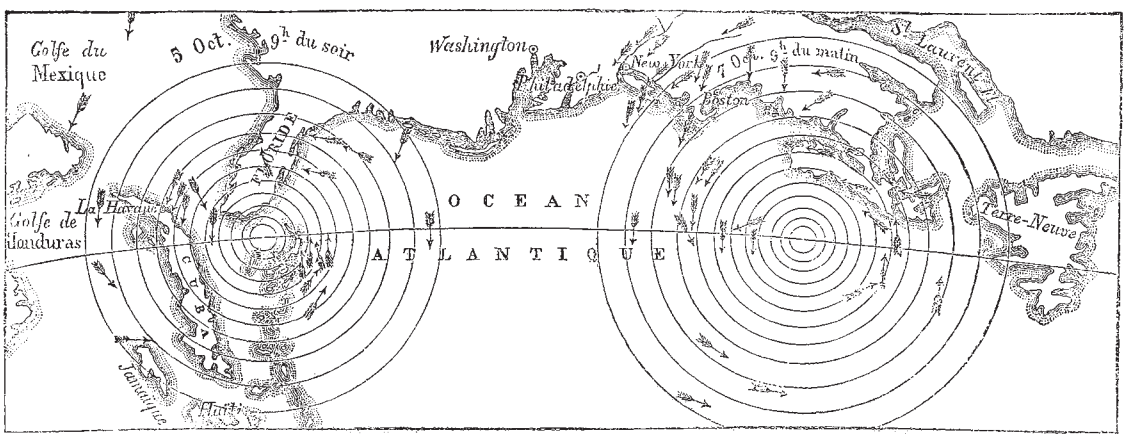

FIG. 1.—Hurricane at Cuba from Oct. 5 to 7, 1844.

to the left in the northern hemisphere, to the right in the southern hemisphere.

Finally, the trajectories present some very striking common characteristics in each hemisphere, and in both hemispheres a remarkable symmetry. The lines tracked by the centres of these cyclones do not descend directly from the equator to either pole; on the contrary, they incline first to the west, then, after having passed the limit of the trade-winds, they bend towards the east, in a final direction roughly perpendicular to the former. Fig. 2 will enable the reader to follow in the two hemispheres the development of cyclones. Originating not far from the zone of calms or of variable winds, on both sides of the equatorial zone, they measure scarcely more than two or three degrees at the outset, but as they proceed towards higher latitudes their area gradually enlarges. In the two temperate zones they attain a diameter of more than ten degrees, and frequently occupy upon the terrestrial globe a space considerably larger than that of France.

Thus all is symmetrical on each side of the equator, or rather of the zone of calms, which oscillates a little each year with the course of the sun. There is symmetry in the direction of rotation, symmetry in the direction of progressive motion, general symmetry in the figure of all these trajectories; and this holds good all over the globe.

Such are the storm laws, the discovery of which is mainly due to England and the United States, "the two greatest maritime powers of the world." The product purely of observation, of empiricism, to use that word in its highest sense, they have not yet reached the stage of theory. On the contrary, in order to discover these laws, it has been necessary to cast aside contemporary prejudices and doctrines, the deadening influence of which we have hourly opportunities of witnessing.

Practical Rules.—But the practical object of these investigations is to save human life. Do we know of no premonitory signs? After the cyclone has commenced, have we any means of discovering the direction of the centre where the rotation is accelerated, where all the sources of danger are accumulated? How can we find out the direction of its march? How learn whether a ship is caught in the dangerous region, where the rate of the wind is the sum of the rates of rotation and of progress; or in the moderate region, where the rate of the wind is only the difference? Finally, what manœuvres are necessary in order to avoid the tornado or to escape from it if by mischance we should be caught in it?

To all these questions there are answers, some exact, imperative as are the exigencies of the danger; others more elastic, leaving room for tact and ability on the par of a commander.

By a fall continuous and prolonged, the barometer, which is never at fault in the tropics, announces that a cyclone is at a distance. As soon as the wind blows with

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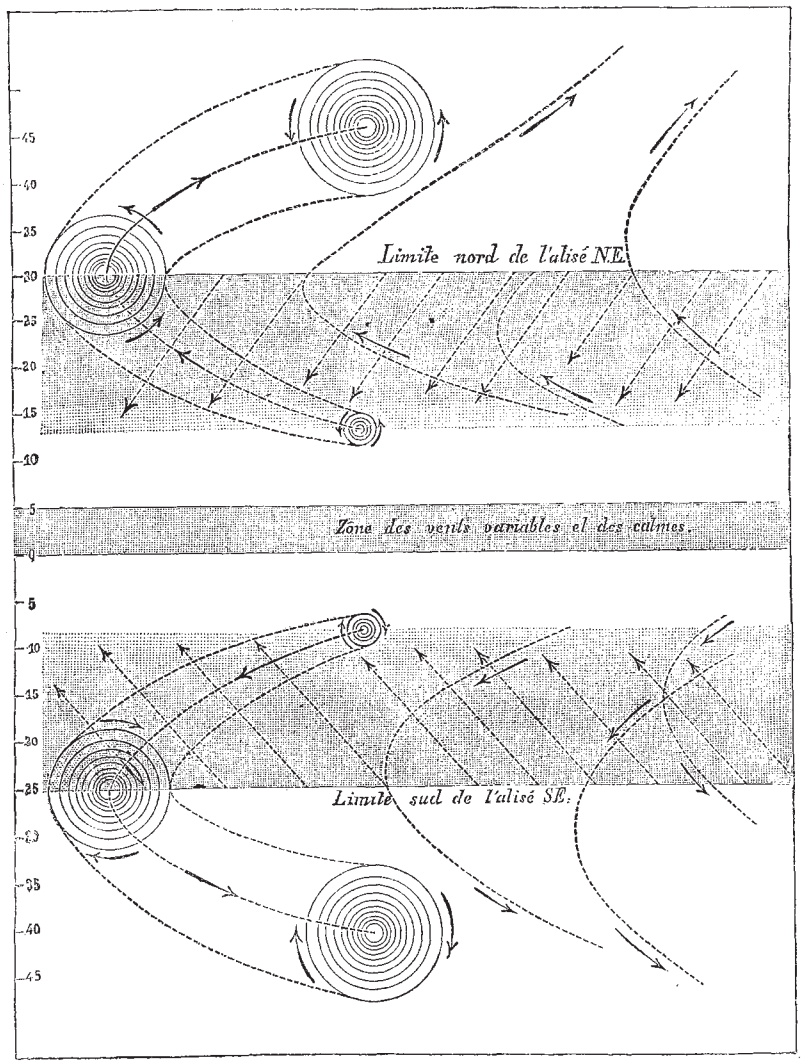
a certain force, it is easy to determine the direction in which the centre of the cyclone will be found. The following is Piddington's rule :—Turn the face to the wind and stretch out the right arm ; the centre is in this direction. The left arm must be used when a ship is in the southern seas. Soon the wind increases, and the fall of the barometer becomes more rapid ; the centre is getting nearer, for the cyclone has an onward motion. If the wind continues to increase without changing direction, you are in the very path of the centre, and soon you will be in the very heart of the tempest. Then suddenly a calm ensues; at the centre of the cyclone exists a circular space where a relative calm prevails. There the sky reassuming its serenity, the sailor might be led to believe himself safe ; but this space is soon passed, and immediately the tempest recommences. Only the wind has suddenly jumped round 180 degrees ; it blows now in the direction opposite to the previous one, at right angles to the trajectory of the centre of the cyclone.

The situation which we have just supposed is a peculiar case ; in general the vessel will be found to the right or the left of this trajectory, whose direction, moreover, an

FIG. 2.—Hurricanes of the northern hemisphere (July to October).



Hurricanes of the southern hemisphere (January to April).

attempt must be made to determine.* The alternative is far from being a matter of indifference ; it is a question of life or death, for the one corresponds to the favourable semicircle, the other to the dangerous. The following is Reid's rule, which eliminates all uncertainty :—In whatever hemisphere, if the wind changes direction successively by turning in the same direction as the cyclone itself, the favourable semicircle is indicated ; if the wind changes by turning in the direction opposite to that of the proper rotation of the cyclone, the dangerous semicircle is indicated.

This may be accounted for by examining Fig. 3. The observer, supposed to be immovable, has his face turned towards the series of winds which will strike him successively as the cyclone passes over him.

In the favourable semicircle (southern hemisphere), if the ship behaves well in a rough sea, it is possible to avoid the centre and the cyclone itself by the shortest way, perpendicularly to its trajectory. The storm is

* We do not dwell on this last point, which can only be solved by skilfully comparing the indications of the barometer with those of the direction and force of the winds.

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always formidable, but it is manageable. If, however, the violence of the wind, the state of the sea, and the weakness of the ship should make flight impossible, there should be no hesitation in putting about ship and bringing to on the starboard tack (the wind on the right side). The vessel appears then to make for the centre of the

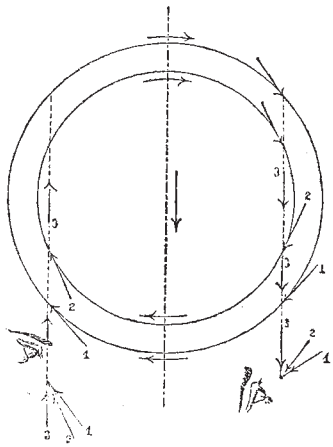

FIG. 3.

hurricane, but it makes no headway; it thus escapes being covered by the wind, and there is no risk of being struck by seas behind, inevitable consequences of a port tack. Soon the hurricane disappears by its motion of translation, good weather reappears, and at last sail may be made.

(*To be continued.*)

THE BRITISH ASSOCIATION

THE second *soirée* was very interesting, although not remarkable for novelties. The Post Office Telegraphic staff appeared in force, showing all varieties of method and apparatus. A splendid series of Geissler vacuum tubes was exhibited by Mr. F. J. Fry. Sir W. Thomson's tide-gauge and tide-calculator, the apparatus for deep-sea sounding, models of railway signals, means of communication between passengers and guard, and Dr. Leitner's collections from Dardistan were among the most attractive objects.

The concluding general meeting presented no remarkable feature, and called forth no very notable speeches. Among the papers to be printed in full in the Report is that of Prof. Cayley, on the application of mathematical trees to chemical theory. The local committee and officials were thanked most heartily and deservedly. They have had the best intentions, adequate means, and good plans, and have employed the energy needed for the fruition of their ideas. The actual number of members, associates, and ladies present during the meeting was 2,249, the number having been somewhat swelled by late arrivals.

The vote of thanks to the President, moved by Sir W. Thomson and seconded by Dr. Carpenter, was not merely formal. Sir W. Thomson eulogised Sir John Hawkshaw as a man who believed that good practice proceeded from good theory. Certainly the President's tone of mind seems to have influenced the work and proceedings of the meeting, for it has been on the whole quiet and genial, yet busy and important in useful results obtained by the scientific employment of common sense, if not of imagination. Thus ended the formal proceedings of a meeting in which three Sections had to sit up to the latest moment in order to get through their work.

The following is the list of grants of money appropriated to scientific purposes. The names of the members who would be entitled to call on the general treasurer for the respective grants are prefixed :—

	£	s.	d.
Mathematics and Physics.			
*Cayley, Prof.—Printing Mathematical Table ...	159	4	9
*Brooke, Mr.—British Rainfall	100	0	0
*Glaisher, Mr. J.—Luminous Meteors (25*l.* renewed)	30	0	0
*Maxwell, Prof. C.—Testing the exactness of Ohm's Law (renewed)	50	0	0
*Stokes, Prof.—Reflective Power of Silver and other Substances (renewed)...	20	0	0
*Tait, Prof.—Thermo-Electricity (renewed)	50	0	0
Thomson, Sir W.—Tide Calculating Machine ...	200	0	0
Chemistry.			
*Roscoe, Prof.—Specific Volume of Liquids... ...	25	0	0
*Armstrong, Dr.—Isomeric Cresols and the Law of Substitution in the Phenol Series	10	0	0
Clowes, Mr. F.—Action of Ethylbromobutyrate on Ethyl Sod-aceto-acetate	10	0	0
*Allen, Mr.—Estimation of Potash and Phosphoric Acid	20	0	0
Geology.			
*Lubbock, Sir J., Bart.—Exploration of Victoria Cave, Settle...	100	0	0
*Evans, Mr. J.—Record of the Progress of Geology	100	0	0
*Evans, Mr. J.—Kent's Cavern Exploration... ...	100	0	0
*Herschel, Prof.—Thermal Conductivities of Rocks	10	0	0
*Hull, Prof.—Underground Waters in the New Red Sandstone and Permian	10	0	0
*Bryce, Dr.—Earthquakes in Scotland	20	0	0
Biology.			
*Sclater, Mr.—Record of the Progress of Zoology..	100	0	0
*Dresser, Mr.—Close Time for the Protection of Indigenous Animals	5	0	0
Balfour, Prof.—Physiological Action of Sound ...	25	0	0
Huxley, Prof.—Zoological Station at Naples ...	75	0	0
*Brunton, Dr. L.—Nature of Intestinal Secretion...	20	0	0
Fox, Col. Lane—Instructions for Use of Travellers	25	0	0
Fox, Col. Lane—Prehistoric Explorations	25	0	0
Statistics and Economic Science.			
Beddoe, Dr.—Examination of Physical Characters of the Inhabitants of the British Isles	100	0	0
Mechanics.			
*Froude, Mr. W.—Instruments for Measuring the Speed of Ships (renewed)...	50	0	0
Napier, Mr. J.—Effect of the Propeller on the Turning of Steam Vessels	50	0	0
	£1489	4	9

* Re-appointed.

I was fortunate enough to get a ticket for the Salisbury and Stonehenge excursion, for which the applications were very numerous. Mr. Blackmore's magnificent museum illustrating the Stone Age was a delight to all scientific minds; and the presence of the founder, his brother, and his brother-in-law, Mr. E. T. Stevens, enhanced the pleasure of the visit. The Cathedral and Stonehenge, in addition, made up a very full day's round. The Mayor of Bristol took a party to Bowood and Avebury. How the Rev. Bryan King obtained his data for estimating that Avebury was about seven centuries older than Stonehenge I cannot conceive. The Silbury tumulus afforded a splendid view to the visitors, if very little science could be got out of it. A third party, that drove through the Cheddar valley, saw at Stanton Drew yet a third of the famous stone erections so conveniently placed around Bristol. The Tortworth excursion was a really hard day's work among many varieties of rock, especially palæozoic, but it was as profitable as it was hard, for the geologist. The Bristol waterworks were of high interest for engineers; and the attractions of Bath, Wells, and Tintern were displayed to every advantage by reason of beautiful weather and hearty welcomes.

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